Illinois Gulch Mine Water Flow Path Investigation

Willard Adit #1 – Puzzle and Gold Dust Mines

Willard Adit #2 – Unknown Mine Operation

Cally Spring

Puzzle Extension Shaft – Puzzle Mine

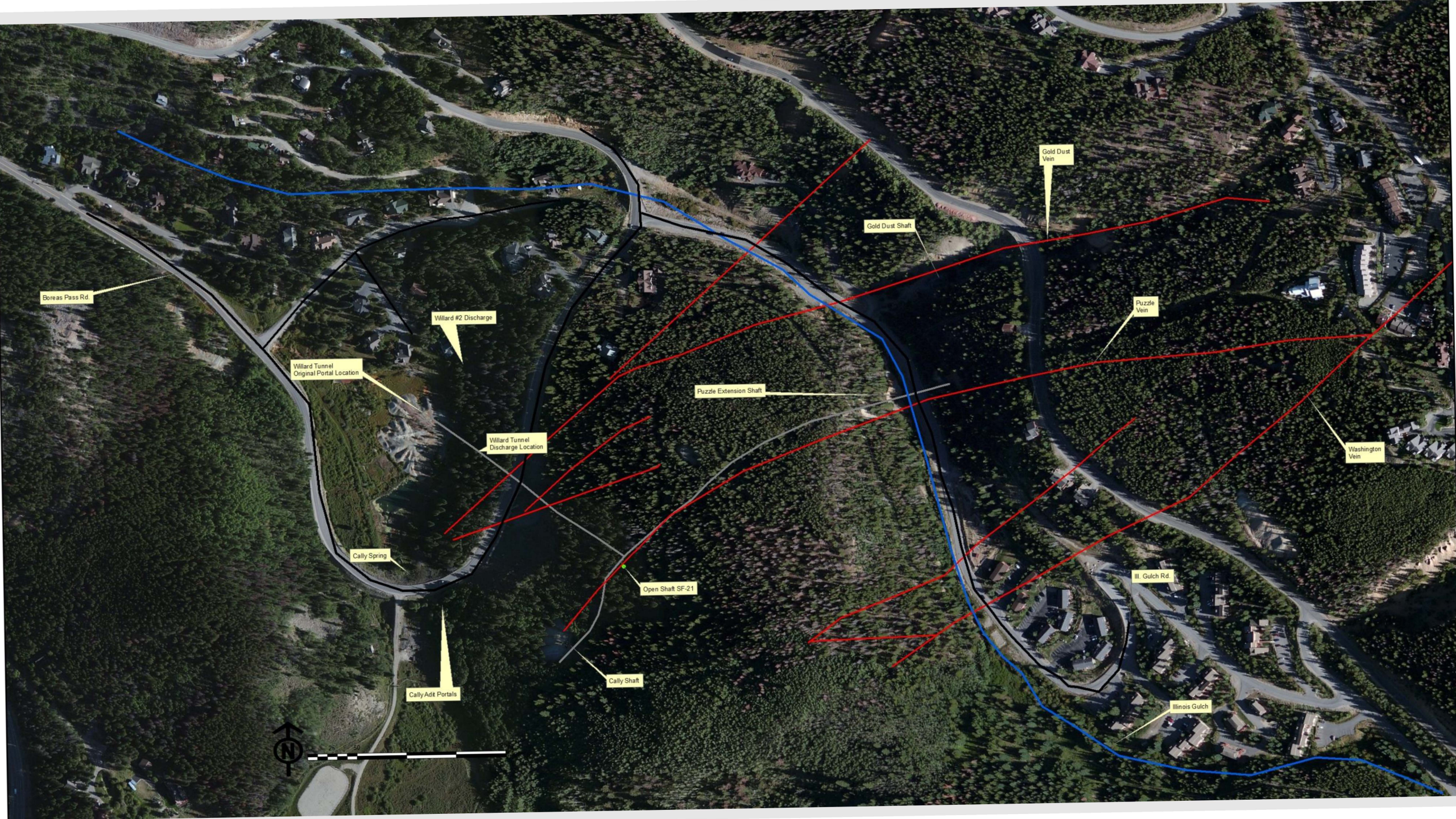
Cally Adits – Ouray Mine

Cally Shaft – Ouray Mine

Illinois Gulch impaired relative to zinc and cadmium below confluence with Iron Springs Gulch. Intensive additional investigations since 2011.

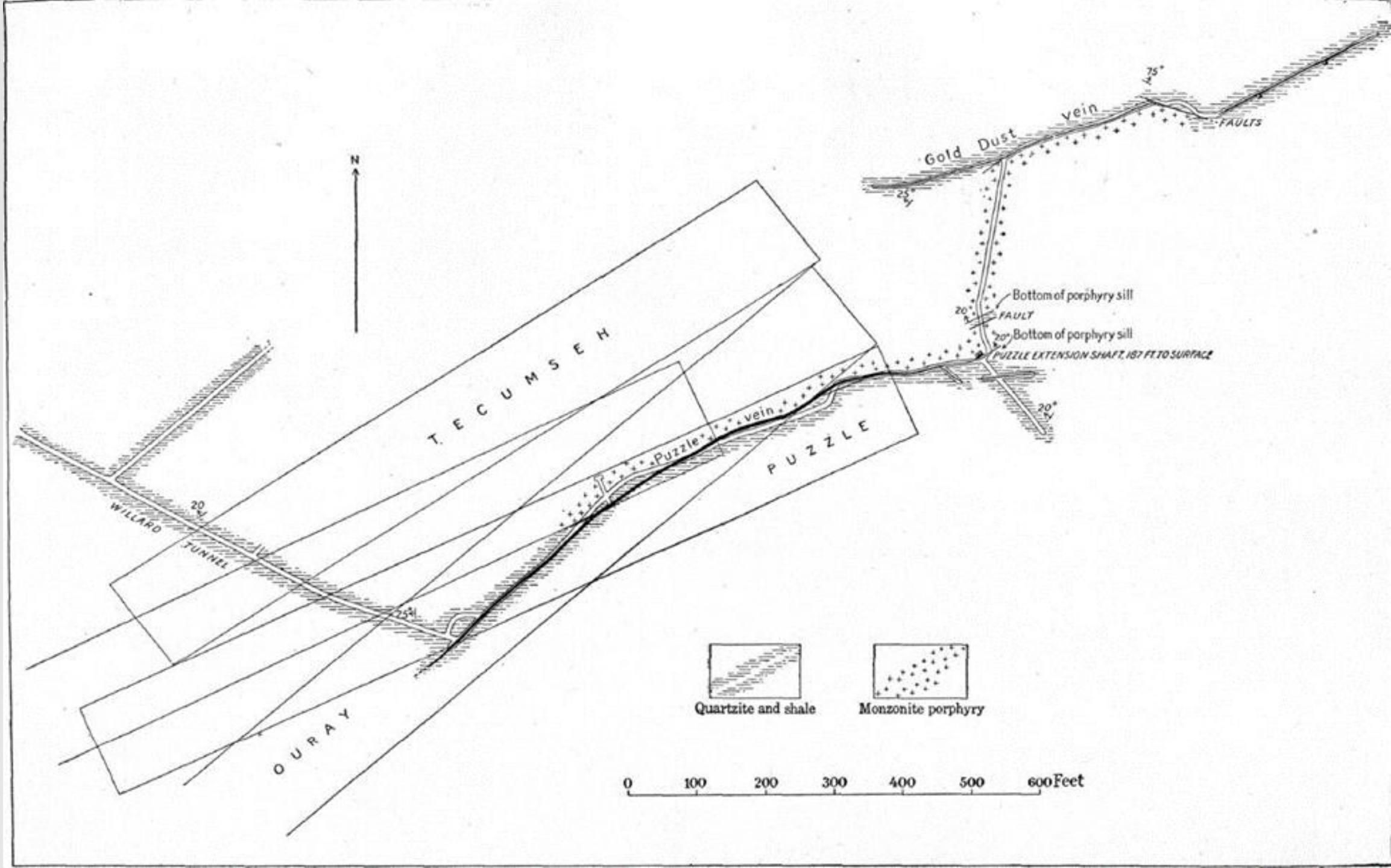
Inflows to Iron Springs Gulch located around the Willard adit waste rock dump

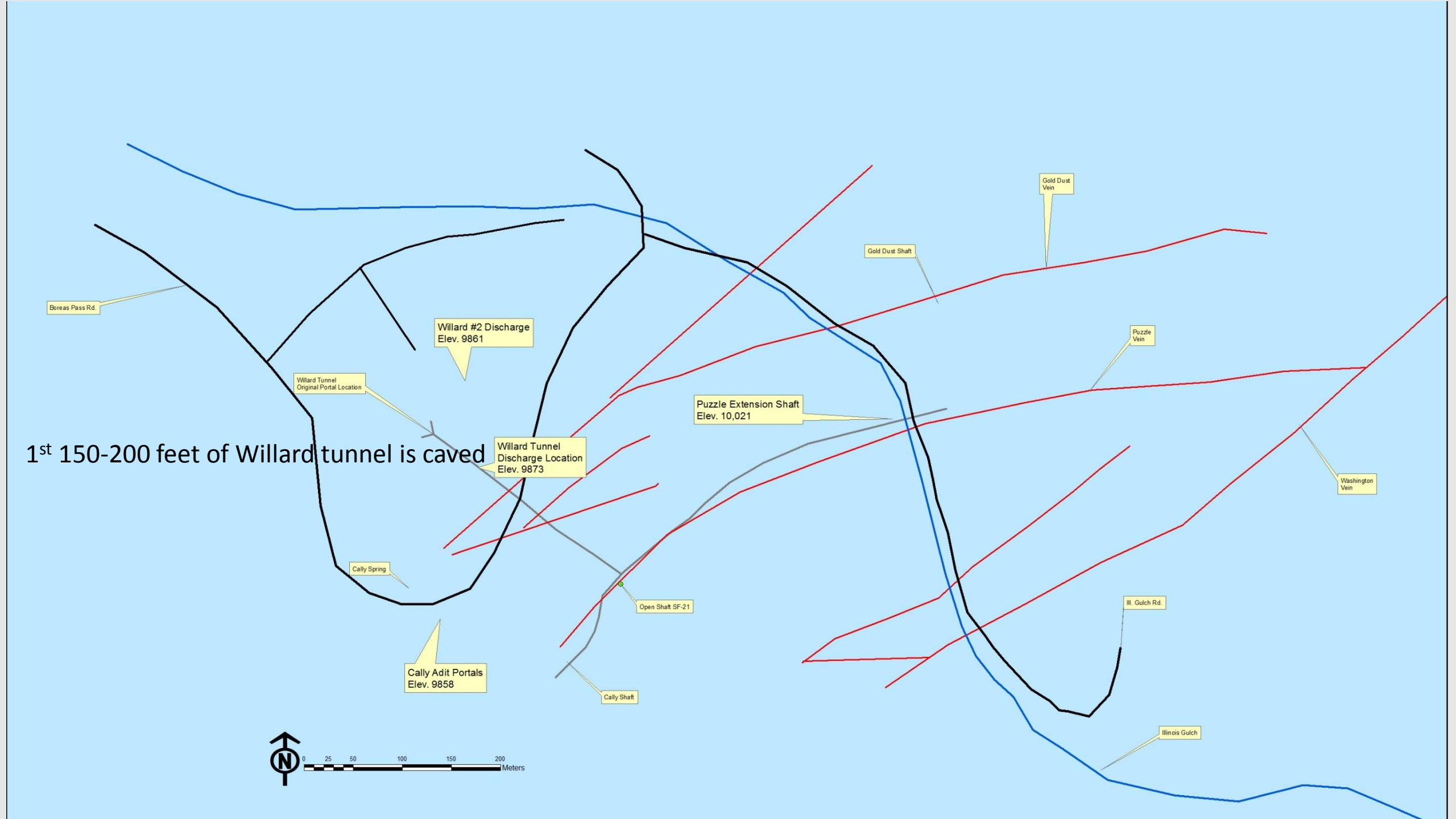
Willard level workings and Puzzle Extension shaft in relation to Illinois Creek and Dry Gulch


Boreas Pass Rd
Willard #2 Discharge
Willard Tunnel
Original Portal Location
Willard Tunnel
Discharge Location
Cally Spring
Cally Adit Portals
Open Shaft SF-21
Cally Shaft
Puzzle Extension Shaft
Gold Dust
Vein
Gold Dust Shaft
Puzzle
Vein
Washington
Vein
Ill. Gulch Rd.
Illinois Gulch
N
25
50

There were two mines exploiting the Puzzle vein. The Puzzle mine, through the Willard adit, and the Ouray mine via the Cally adits and shaft.

The Gold Dust vein in Dry Gulch was also mined via the Willard adit

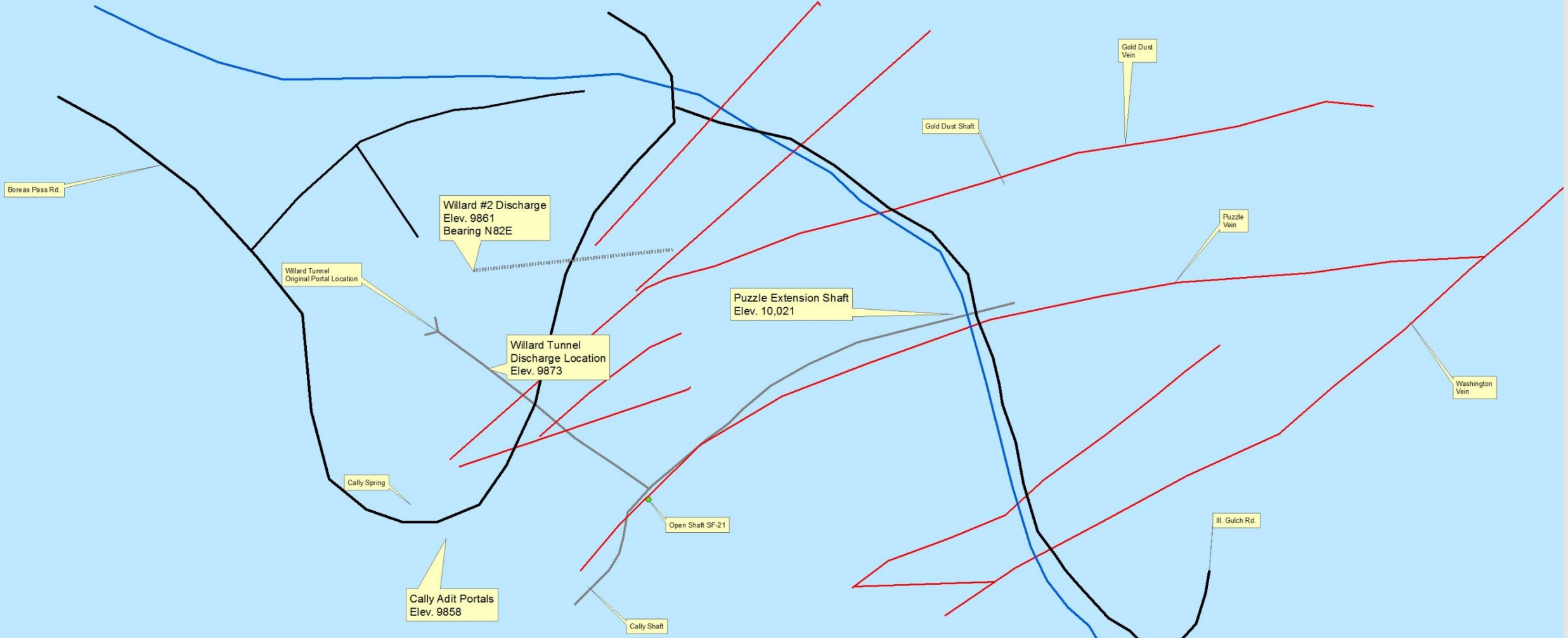




1st 150-200 feet of Willard tunnel is caved

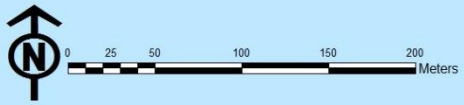
Willard adit cap timbers correspond with adit ceiling (back)

Drainage emerging six feet above cap timbers indicating that the adit is flooded

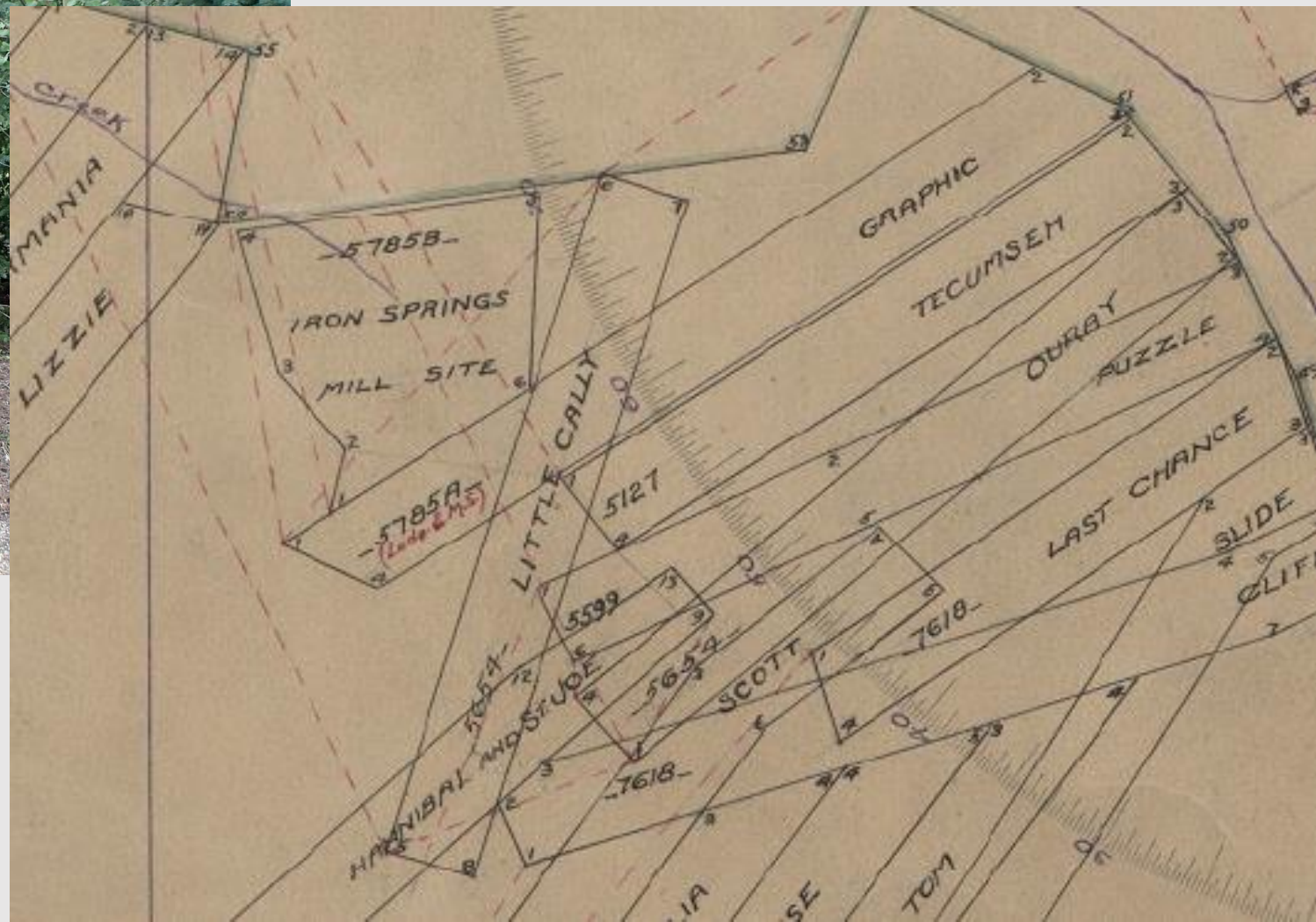


What is known about Willard adit #2?

1. Bearing taken from portal indications is speculative
2. No waste dump to give indication of adit length
3. Does appear to diverge in bearing from Willard adit



Who is Cally?

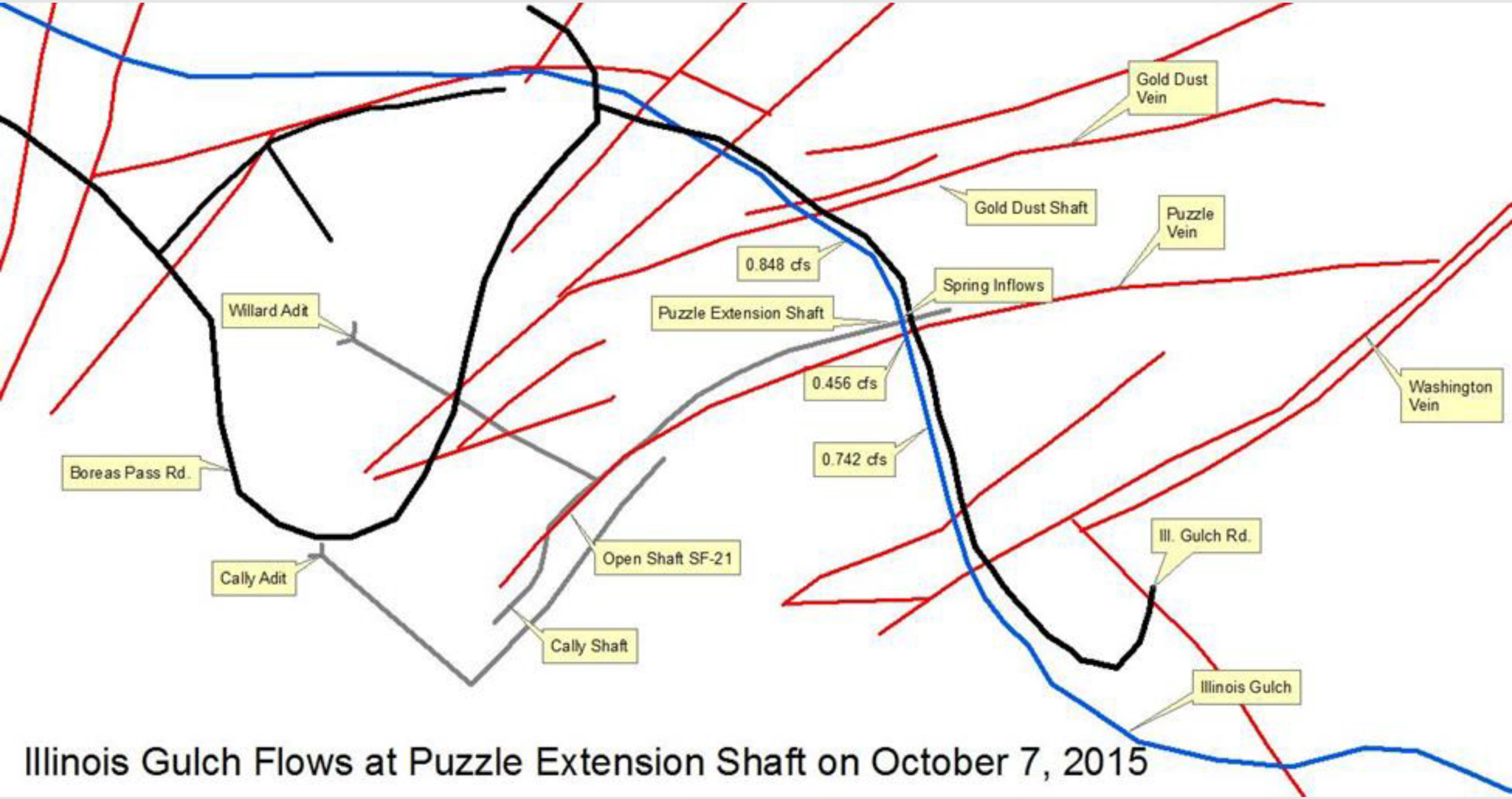


Cally adit portals are a little over 100 feet from the Cally spring

Is this the Cally spring?

"…iron is taken up by the ground water in any reaction involving the replacement of pyrite by sphalerite or galena, so that any of this water emerging as springs…is likely to be highly ferruginous, as is that of a spring near the Puzzle and Ouray mines."

Ransome (1911) USGS Professional Paper 75, page 169



Illinois Gulch Flows at Puzzle Extension Shaft on October 7, 2015

Uranine Dye Tracer June-July 2016

Injection into collapsed 2-compartment Puzzle Extension shaft

Shaft is adjacent to Illinois Creek, and base of collapse craters are approx. 10-feet above creek

Design and Implementation of the Dye Test

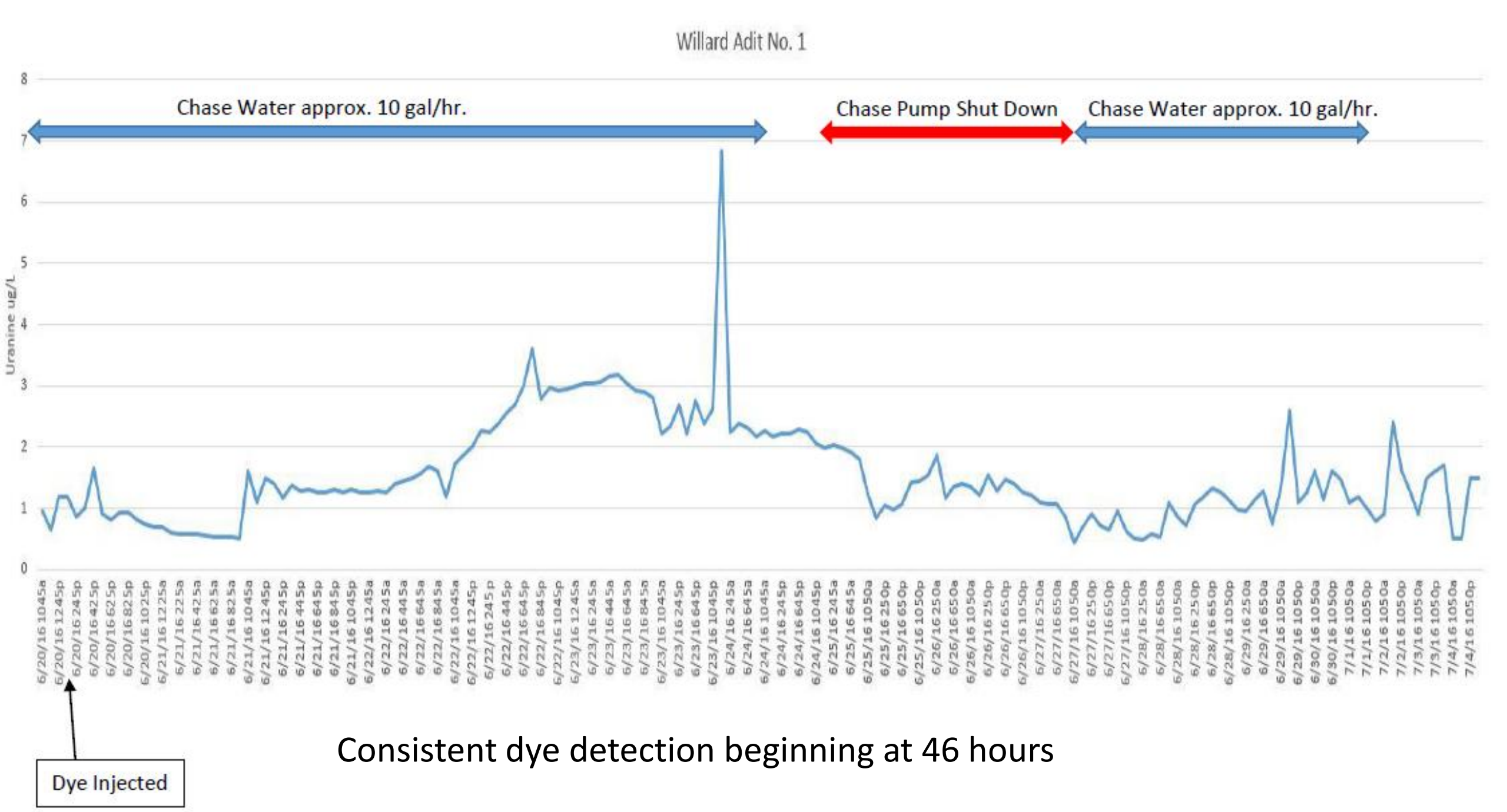
Largely qualitative

Two objectives:

- Determine if a hydrologic flow path is present that would transmit water injected into the Puzzle Extension shaft to the headwaters of Iron Springs Gulch.
- Instruct the planning for duration of the USGS investigation in terms of transit times for water originating near the Puzzle Extension shaft to the headwaters of Iron Springs Gulch.

Auto-samplers at Willard #1, Willard #2, and Cally spring

Dye concentration measured with field fluorimeter



Consistent dye detection beginning at 46 hours

No Detection at Willard adit #2 or Cally spring

- Duration of test at Willard adit #2 was 11.5 days
- Duration of test at Cally spring was 14.5 days

- Uranine was detected at Cally spring in one sample on day 10, but there was no detection in samples 6-hours before and after this detection, indicating an unexplained false positive

Conclusions Drawn from the Data

- There is a hydrologic flow path from Illinois Creek through the Puzzle Extension mine and Puzzle mine workings to the Willard level of the Puzzle mine and the Willard adit portal and the headwaters of Iron Springs gulch.
- Gave confidence to USGS salt tracer test planned duration, at least for Willard adit #1.
- Less than five percent of the dye injected into the Puzzle Extension shaft issued from the Willard adit during the course of the investigation. It is likely that much of the dye was deterred in the pore spaces of the mine waste collapsed into the shaft, and that additional chase water would have moved a greater percentage of the dye through the system.

Dye testing completed without visual impacts to Illinois Creek or Blue River